

Claims

1. A photocatalyst including a matrix, the matrix comprising:

5 a substrate; and
oxide-based nanomaterial formed on the
substrate.

10 2. The photocatalyst as set forth in claim 1, wherein
the substrate is selected from the group consisting of a
silicon substrate, a glass substrate, a quartz substrate, a
Pyrex substrate, a sapphire substrate, and a plastic
substrate.

15 3. The photocatalyst as set forth in claim 1, wherein
the oxide-based nanomaterial has a shape of a nanoneedle,
nanorod, or nanotube.

4. The photocatalyst as set forth in claim 3, wherein
15 the oxide-based nanomaterial has a multi-wall structure.

20 5. The photocatalyst as set forth in claim 4, wherein
the oxide-based nanomaterial having the multi-wall
structure has a coaxial doublewall structure including ZnO
and TiO₂ as main components.

6. The photocatalyst as set forth in claim 1, wherein

the oxide-based nanomaterial has a heterojunction structure of metal/oxide semiconductor formed by depositing metal on an oxide semiconductor nanorod.

7. The photocatalyst as set forth in claim 6, wherein
5 the metal is deposited on the oxide semiconductor nanorod through a sputtering process or a thermal or electron beam evaporation process.

8. The photocatalyst as set forth in claim 6, wherein
10 an oxide semiconductor comprises ZnO as a main component, and one or more metals, which are selected from the group consisting of silicide-based metals, including Ni, Pt, Pd, Au, Ag, W, Ti, Al, In, Cu, PtSi, and NiSi, is used.

9. The photocatalyst as set forth in claim 1, wherein
15 the oxide-based nanomaterial is vertically oriented on the substrate.

10. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial is formed on the substrate through any one of a metal-organic chemical vapor deposition process, a sputtering process, a thermal or
20 electron beam evaporation process, a pulse laser deposition process, a vapor-phase transport process, and a chemical synthesis process.

11. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial has a diameter from 5 to 200 nm and a length from 0.5 to 100 μm .

12. The photocatalyst as set forth in claim 1, 5 wherein the oxide-based nanomaterial comprises ZnO as a main component.

13. The photocatalyst as set forth in claim 12, wherein the oxide-based nanomaterial comprises one or more elements selected from the group consisting of Mg, Cd, Ti, 10 Li, Cu, Al, Ni, Y, Ag, Mn, V, Fe, La, Ta, Nb, Ga, In, S, Se, P, As, Co, Cr, B, N, Sb, and H, as impurities, in addition to ZnO as the main component.

14. The photocatalyst as set forth in claim 12, wherein the oxide-based nanomaterial is coated with any one 15 compound selected from the group consisting of MgO, CdO, GaN, AlN, InN, GaAs, GaP, InP, and compounds thereof.

15. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial comprises TiO₂ as a main component.

20 16. The photocatalyst as set forth in claim 15, wherein the oxide-based nanomaterial comprises one or more elements selected from the group consisting of Mg, Cd, Zn,

Li, Cu, Al, Ni, Y, Ag, Mn, V, Fe, La, Ta, Nb, Ga, In, S, Se, P, As, Co, Cr, B, N, Sb, and H, as impurities, in addition to TiO₂ as the main component.

17. The photocatalyst as set forth in claim 15,
5 wherein the oxide-based nanomaterial is coated with any one compound selected from the group consisting of MgO, CdO, GaN, AlN, InN, GaAs, GaP, InP, and compounds thereof.